

RUST FUNGI FROM VARIOUS SOURCES

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This paper deals with collections of rusts from scattered localities throughout the world. Over the years, colleagues have handed on rust material collected on expeditions, Mr. B. L. Burt from S Africa, Malawi and W Pakistan, Miss J. Lamond from W Pakistan and some specimens from S Africa collected by E. M. Laughton and received through the kindness of Dr. O. M. Hilliard. During the course of extensive travels in 1967, I collected rusts on any opportunity and so amassed a miscellaneous collection from many scattered localities. I am particularly indebted to a number of local botanists who named the host plants for me on my travels, especially Dr. Saho and Prof. Hattori in Japan, Dr. Chang in Hongkong, Mr. Prodhon in Darjeeling, Dr. R. E. Vaughan in Mauritius and Prof. Rycroft in S Africa.

The rusts have been arranged in order of their host families in this paper for this most often brings together closely related species and on a world scale the identification of rusts rests heavily—but often quite justifiably—on the identity of the host.

APOCYNACEAE

Puccinia tabernaemontanae Cke. in Grevillea 10: 125 (1882).

On *Carvalhoa macrophylla* K. Schum. Malawi, Mt. Nchisi, 14 i 1967, Burt & Hilliard 4479.

The aecidiospores in this collection have irregularly thickened walls—up to 20 μ m at the apex—which is quite characteristic of *P. tabernaemontanae* as described in detail by Doidge (1927). *P. tabernaemontanae* is known on the apocynaceous *Conopharyngia ventricosa* in S Africa and Ceylon; *Carvalhoa* is a new host genus.

BALSAMINACEAE

Aecidium impatientis-capensis Doidge in Bothalia 2: 181 (1927).

On *Impatiens gomphophylla* Bak. Malawi: Khulamino Hill, i 1967, Burt & Hilliard 6327.

This collection probably belongs to Doidge's species. She described the aecidiospores as delicately verruculose and the Malawi collection has similar spores and sori but the spores have abundant, distinctive refractive granules; at the time of Doidge's paper these granules were usually ignored except by Klebahn. Isotype material in the herbarium of the Commonwealth Mycological Institute (I.M.I. 53,846) has identical refractive granules and agrees in all other respects.

BERBERIDACEAE

Aecidium akebiae Hennings in Hedwigia 39: 154 (1900).

On *Akebia quinata* (Thunb.) Decne. Japan: Kyushu, Nichinan, Udo, 7 vii 1967, Henderson 9303.

The aecidiospores of this collection of *A. akebiae* have uniformly thickened walls and conspicuous refractive granules.

COMPOSITAE

Aecidium anceps Syd. in Hedwigia 40: 1 (1901).

On *Senecio* sp. S Africa: Pretoria North, ix 1960, *E. M. Laughton*.

Aecidiospores finely verruculose with conspicuous refractive granules, 13–15 μ m in diameter.

Aecidium dubiosum Syd. in Hedwigia 40: 1 (1901).

On *Senecio* sp. Malawi: Nyika plateau, Chelinda bridge, i 1967, *Hilliard & Burt* 4397.

Aecidiospores lacking refractive granules, wall thin but up to 10 μ m at apex, often oblong-rounded c. 12–14 \times 8–10 μ m.

On *Senecio tamoides* DC. S Africa: Natal, Dargle, xii 1965, *Burt & Hilliard* 3200.

Aecidium rhodesicum Cummins in Bull. Torrey Bot. Club 87: 32 (1960).

On *Eupatorium africanum* O.&H. Malawi: Nyika plateau near north Kukurru bridge, i 1967, *Hilliard & Burt* 4434.

Spermogonia and aecidia only. The aecidia have the same non-persistent peridium described by Cummins in his original description—also on *E. africanum*.

The aecidiospores show unusual ornamentation. The general surface is finely verruculose but refractive granules are also present, and occur in small groups of up to eight together.

Uromyces bidenticola Arth. in Mycologia 9: 71 (1917).

On *Bidens pilosa* L. Hawaii: Lyon Arboretum, 14 vi 1967, *Henderson* 9315. II only.

CYPERACEAE

Puccinia canaliculata (Schw.) Lagerheim in Tromsø Mus. Aarsh. 17: 51 (1894).

On *Cyperus denudatus* L. Mauritius: Macabé, 2 xi 1967, *Henderson*.

Uredosori only; uredospores elliptic to spherical, 20–25 \times 15–22 μ m, thin-walled (c. 1 μ m) with two indistinct equatorial pores, distinctly echinulate.

This species is not recorded from Mauritius (Wiehe, 1948) but is known from Madagascar and the African mainland (Jørstad, 1956).

Uredo kyllingae P. Hennings in Hedwigia 35: 256 (1896).

On *Kyllinga* sp. Mauritius: Park Hotel, Curepipe, 2 xi 1967, *Henderson* 9325, II only.

Uredosori scattered, hypophyllous, aparaphysate; uredospores ellipsoid, 25–30 \times 20–22 μ m, wall sparsely echinulate, c. 1.5 μ m thick with 2–3 indistinct equatorial pores.

The rust fungi on *Kyllinga* exhibit the same features common to those on other genera of the Cyperaceae. Some races are wholly uredosporic—often referred to *Uredo kyllingae* P. Henn., while in E Asia telial states are known and the rust presumably alternates with members of the Compositae. Doidge (1939) described *P. kyllingicola* from one collection from S Africa with telia and this Mauritian collection fits exactly her description of the uredospore

stage, but the abundance of uredosori suggests a race independent of alternation. *Uredo kyllingae* has been recorded from Mauritius by Wiehe (1948).

Uredo sp.

On *Scleria* sp. Malaya: Kuala Lumpur, in agriculture faculty experimental ground, 16 viii 1967, *Henderson* 9312.

Uredinia only; uredospores ellipsoid, $20-23 \times 15-17\mu\text{m}$, wall $1.5\mu\text{m}$ thick with two equatorial pores, echinulate with smooth areas around and below the pores.

This rust on *Scleria* is interesting as it shows resemblance to that group of cyperaceous rusts in temperate regions with aecidial stages on Compositae, the common species of the group being *Puccinia dioicae*.

EBENACEAE

Cronartium gilgianum P. Hennings in Bot. Jahrb. 22: 53 (1895).

On *Euclea* sp. Malawi: Mt. Mlanje, Chambe basin, 1820m, *Burt & Hilliard* 4572.

The telia of this rust occurs in dense, dark, hair-like masses on the under surfaces of the host leaves.

Aecidium royenae Cooke & Masee in Grevillea 17: 70 (1889).

On *Royena sericea* Bernh. Malawi: Mdimba Mt. near Blantyre, 1370m, *Burt & Hilliard* 4108.

Aecidium royenae usually induces witches'-broom on *R. sericea* to judge from collections in the herbarium of the Commonwealth Mycological Institute. The present collection shows scattered infection becoming only partially systemic and probably represents a very early stage of broom formation. Microscopically the Malawi collection matches perfectly a typical broom-type collection (I.M.I. 74937). The aecidiospores are $20-25\mu\text{m}$ diameter, wall uniformly $1\mu\text{m}$ thick, minutely verruculose without refractive granules or visible pores.

ELAEAGNACEAE

Aecidium elaeagni Dietel in Hedwigia 37: 571 (1900).

On *Elaeagnus pungens* Thunb. Japan: Kyushu, Udo near Nichinan, 7 vii 1967, *Henderson* 9334.

Spermogonia dark brown on conspicuous yellow spots. Aecidia 25-30 together; aecidiospores angular, $20-25\mu\text{m}$ diameter, wall less than $2\mu\text{m}$ thick, finely verrucose without pores or refractive granules.

ERICACEAE

Uredo gaultheriae (Syd.) Hiratsuka f. in Trans. Myc. Soc. Japan 5: 4 (1957).

On *Gaultheria nummularioides* D. Don. India: Darjeeling, Tonglo, 3050m, *Henderson* 9322, II only.

Uredosori hypophyllous, c. 1 mm diameter, on brown discoloured areas of the host leaf; uredospores oblong-ellipsoidal, $35-31 \times 17-21\mu\text{m}$, wall $0.5-0.8\mu\text{m}$ thick, echinulate with long sharp spines, pores not observed.

This species has been known hitherto only from the type collection. It

is undoubtedly a *Pucciniastrum* but telia have not been described and prolonged search has not revealed any in my collection. The uredospores could not be distinguished morphologically from widespread species such as *Pucciniastrum vaecinii*. In the Darjeeling area but slightly higher than my collection, alternation with *Abies pindrow* would be possible.

EUPHORBIACEAE

Melampsora euphorbiae Cast., Obs. Pl. Acotyl. 2: 18 (1843).

On *Euphorbia geniculata* Ortega. S Africa: Pretoria, 10 ii 1960, *E. M. Laughton*, II only.

GERANIACEAE

Puccinia granularis Kalch. & Cooke in Grevillea 11: 22 (1882).

On *Pelargonium* sp. S Africa, Sabie, vi 1960, *Laughton*.

Uredinia only, spores with 2 equatorial pores and wall 3-3.5 μ m thick.

GRAMINEAE

Puccinia coronata Corda, Icon. Fung. 1: 6 (1837).

On *Helictotrichon asperum* (Munro) Bor. India: Darjeeling, Tongloo, 3050m, 8 viii 1967, *Henderson*.

Uredinia only, paraphysate, spores subglobose 25 μ m diameter, echinulate, very thin-walled with 8-9 scattered pores.

This is the rust described by Barclay as *Puccinia himalensis* and is known to alternate in some strains with species of *Rhamnus*.

Puccinia nakonishikii Dietel in Bot. Jahrb. 34: 585 (1905).

On *Cymbopogon citratus* (DC.) Stapf. Malaya: Kuala Lumpur, faculty of agriculture experimental ground, 18 viii 1967, *Henderson*.

Uredinia only, paraphysate, uredospores with usually five equatorial pores.

Puccinia phragmitis (Schum.) Kornicke in Hedwigia 15: 179 (1876).

On *Phragmites communis* L. Turkey: Hakkari, Yüsekova, 1950m, ix 1967, *Duncan & Tait* 214.

Puccinia striiformis West. in Bull. Roy. Acad. Belg. 21: 235 (1854).

On *Brachypodium sylvaticum* (Huds.) P. Beauv. India: Darjeeling, 2550m, 6 viii 1967, *Henderson* 9314.

IRIDACEAE

Puccinia iridis Rahb., Deutschl. Krypt.-Fl. 1: 23 (1844).

On *Iris germanica* L. S Africa: Pretoria, collected in a private garden, ii 1960, *Laughton*.

Uredinia only. The uredospores measure mostly 30 \times 26 μ m and so correspond to the medium-sized race to which attention has been drawn in Europe (Wilson and Henderson, 1964) and which is the common type on cultivated irises of the '*germanica*' type.

Uromyces antholyzae Syd. in Ann. Mycol. 2: 27 (1904).

On *Anapalina triticea* (Brum.) N.E.Br. S Africa: Storms River, 12 xi 1967, Henderson 9274.

Uredinia pale, scattered, aparaphysate; uredospores mostly $28 \times 25 \mu\text{m}$, wall echinulate, $1.5\text{--}2 \mu\text{m}$ thick, with 5–6 indistinct, scattered pores. Telia, transversely elongate, stromatic, brown, immersed, with brown thick-walled, paraphysis-like marginal cells; teliospores, rather quadrate, apex rounded with apical pore without papilla, $25\text{--}30 \times 18\text{--}22 \mu\text{m}$, wall smooth, up to $2\text{--}3 \mu\text{m}$ thick at apex, pedicel short.

Doidge (1948) revised the species of *Uromyces* on Iridaceae in S Africa and clearly distinguished between the stromatic and non-stromatic telia. The Storms River Mouth collection differs in some respects from her revised description. I can detect fewer uredospore pores (5–6) than she did (6–8) but they are very indistinct and difficult to observe accurately, the thickened apex of the teliospore is not so great in my collection ($2\text{--}3 \mu\text{m}$) as the figure she gives ($4\text{--}7 \mu\text{m}$). Nevertheless, too many bad species have been described on S African Iridaceae with little allowance made for variability (Jørstad, 1956) and I do not intend to add another. *Anapalina triticea* is a new host for *U. antholyzae*.

LABIATAE

Coleosporium plectranthi Barclay in Jour. Asiatic Soc. Bengal 59: 89 (1890).

On *Plectranthus gerardianus* Benth. India: Darjeeling, 228om, 6 viii 1967, Henderson 9279.

Uredinia and telia; uredospores $20\text{--}35 \times 17\text{--}22 \mu\text{m}$, wall $0.5 \mu\text{m}$ thick, with square warts c. $1 \mu\text{m}$ high and $1 \mu\text{m}$ broad.

This species has been recorded from India on several occasions and is also known in Japan (Hiratsuka, 1960).

LAURACEAE

Aecidium machili Hennings in Hedwigia 41: 21 (1902).

On *Machilus japonica* Sieb. & Zucc. Japan: Kyushu, Nichinan, 7 vii 1968, Henderson 9311.

LILIACEAE

Puccinia ferruginea Lév. in Vaillant, Voyage de la Bonite, 204 (1839–46).

On *Smilax china* L. Hongkong: Tai Po Shan, 14 vii 1967, Henderson 9277. China: Swatow, 3 x 1900, J. M. Dalziel.

Uredinia scattered; uredospores $35\text{--}40 \times 25\text{--}29 \mu\text{m}$, coarsely aculeate, brown, wall up to $5 \mu\text{m}$ with thick laminate structure and 2 (–3) equatorial pores. Telia circinate, leptosporic; teliospores mostly $60\text{--}70 \times 18\text{--}24 \mu\text{m}$, but a few as small as $45 \times 28 \mu\text{m}$, wall smooth, pore of upper cell apical of lower cell superior, pedicel large and rough, mostly $120 \times 18 \mu\text{m}$.

This species is very distinct in the remarkable laminate-walled uredospores and the swollen teliospore pedicels. I have examined material from Africa (Dümmer 1116) typical of *P. krausiana* Cooke, from India (leg. Barclay, Herb. G. Watt) representing *P. prainiana* and do not believe they differ appreciably from my own collection from Hongkong. The species of *Puccinia*

on *Smilax* described from China appear also to be of doubtful validity. The Sydows in their Monographia distinguished *P. citrina* P. & H. Sydow largely on the presence of uredospores and smaller teliospores from *P. smilacis-chinae* Hennings and *P. ferruginea* Lév. But many parts of my own collection bear only telia although uredinia are present on a few leaves, so presence or absence of uredinia is hardly reliable; furthermore, while most of the teliospores in my collection are large and fairly clearly leptosporic the shorter teliospores said to be typical of *P. citrina* are also present. Therefore much of the splitting has been done on presence or absence of uredinia and shape of teliospores—and the latter depends upon the dominance of leptosporic sori as compared to resting sori. The supposed absence of aecidia in *P. citrina*, *P. ferruginea* and *P. smilacis-chinae* is equally fraught with difficulty as a specific character. The collections of *P. krausiana* and *P. prainiana* which I have examined lack aecidia—although their presence is apparently necessary to separate them from the other three species.

The suspicion is clear then that only one main species of this group of Puccinias inhabits *Smilax* and it ranges from China to S Africa. The other group of species on *Smilax* within non-inflated teliospore pedicels is noted under *Puccinia henryana*.

Puccinia henryana H. & P. Sydow, Monographia Uredinearum 1: 633 (1903).

On *Smilax scobinicaulis* Wright. China: Prov. Kweichow, Fan Ching Shan, 1400m, 15 xi 1931, Stewart, Chiao & Cheo 579.

This species bears only telia which match the Sydows' description perfectly. *S. scobinicaulis* is a new host of the species.

Puccinia maianthemii Dietel in Bot. Jahrb. 28: 285 (1901).

On *Maianthemum kamschaticum* (Gmelin) Nakai. Japan: Hokkaido, Yamabe forest, 1 vii 1967, Henderson 9306.

Uredo dianellae Dietel in Hedwigia 37: 213 (1898).

On *Dianella ensifolia* (L.) DC. Malaya: Ulu Kali, N of Kuala Lumpur, 1800m, 15 viii 1967, Henderson.

Uredinia only, on conspicuous purplish spots, paraphysate; uredospores broadly ellipsoid, $25-30 \times 18-23\mu\text{m}$, wall $3\mu\text{m}$ thick, echinulate, with 6-8 scattered pores.

This rust is widely distributed in SW Asia, China, Japan, Ceylon, Java but no telial stage has so far been discovered.

Uromyces veratri Schroeter in Abh. Schles. Ges. Kult. 48: 10 (1869).

On *Veratrum grandiflorum* Loes. f. Japan: Hokkaido, Napporo forest, 27 vi 1967, Henderson 9307.

The species is widespread throughout Eurasia and everywhere is remarkable for the intensity of its attack upon the host which is usually thickly covered by uredinia and telia.

MORACEAE

Aecidium mori Barclay in Jour. Asiatic Soc. Bengal 60: 226 (1891).

On *Morus bombycis* Koidz. Japan: Hokkaido, Sapporo, Mt. Moiwa, 27 vi 1967, Henderson 9309.

ORCHIDACEAE

Coleosporium bletiae Dietel in Hedwigia 37: 216 (1898).

On *Habenaria arietina* Hook. f. India: Darjeeling, 2550m, 10 viii 1967, Henderson 9321.

On *Horminium angustifolium* (Lindl.) Benth. India: Darjeeling, 2550m, 10 viii 1967, Henderson 9320.

Uredinia only, hypophyllous, without peridia; uredospores oblong-ellipsoidal mostly $25-30 \times 13-17\mu\text{m}$, wall $0.5\mu\text{m}$ thick, without obvious pores, ornamented with angular warts with a square profile in optical section of the wall, warts $1.5-2\mu\text{m}$ high, $1.5-2\mu\text{m}$ apart.

Rather than describe yet another 'Uredo' species for these collections of unattached uredinia it seems reasonable to link them with the species already described from Japan. Mundkur and Thirumalachar (1946) described *Coleosporium satyrii* on *Satyrium nepalense* from United Provinces but found only telia.

The Darjeeling collections are of interest in relation to Saho's (1966) work on *Coleosporium* species in Japan. Saho has shown quite clearly that the Japanese *Coleosporia* alternate with five-needled pines and thus differ from the European races which inhabit two-needled pines. Furthermore the Japanese races differ in morphology of uredospores and aecidiospores from the European. As regards uredospores the Japanese races have more coarsely warted spores. The orchid collections have uredospores which agree with the Japanese races rather than the European thus lending support to the most likely host in the Darjeeling areas for the orchid *Coleosporia* being the five-needled pine, *Pinus wallichiana*. Direct comparisons of uredospores were made with Saho's collections of *Coleosporium neopetasitis* and *C. neosenectionis*.

POLYGONACEAE

Puccinia fagopyri Barclay in Journ. Bot. 28: 261 (1890).

On *Fagopyrum cymosum* (Trev.) Meiss. India: Darjeeling, 2280m, 6 viii 1967, Henderson 9281.

Uredinia scattered, c. 1 mm diameter; uredospores broadly ellipsoid, $25-27 \times 20-24\mu\text{m}$, wall $0.5\mu\text{m}$ thick, echinulate in upper part, more or less smooth at base, with two pores near the basal septum.

This species is remarkable for the very low position of the pores in the uredospores. It is closely related to *Puccinia benokiyamensis* Hirats. f. which occurs on various species of *Polygonum* in China and Japan.

Puccinia polygoni-amphibii Pers., Syn. Meth. Fung. 277 (1801).

On *Polygonum runcinatum* Hamilton. India: Darjeeling, 2550m, 7 viii 1967, Henderson 9285.

Uredinia only, uredospores $20-25 \times 18-21\mu\text{m}$, echinulate with two subequatorial pores.

On *Reynoutria japonica* Houtt. Japan: Kyushu, Udo, Nichinan, 7 vii 1967, Henderson 9305, III only.

PRIMULACEAE

Puccinia dieteliana Sydow in Hedwigia 37: 215 (1898).

On *Lysimachia clethroides* Duby. Japan; Kyushu, Nichinan, nr. Inotani, 7 viii 1967, *Henderson* 9290, O, I, III.

This ophis-form is clearly correlated with the microcyclic races of the *Puccinia caricina* group with aecidia on *Lysimachia* and uredinia and telia on *Carex*.

PTERIDACEAE

Milesina pteridicola Hirats. f. in Mem. Tottori Agric. Coll. 3: 256 (1935).

On *Pteris dispar* Kunze. Japan: Kyushu, Nichinan, 10 vii 1967, *Henderson* 9333, II only.

ROSACEAE

Phragmidium rosae-moschatae Dietel in Hedwigia 44: 126 (1905).

On *Rosa brunonii* Lindl. India: Darjeeling, Tongloo, 3050m, 8 viii 1967, *Henderson*, II only.

RUBIACEAE

Hemileia fadogiae Sydow in Ann. Mycol. 10: 34 (1912).

On *Rubia oleoides*. S. Africa: Sabie district, Transvaal, iv 1960, *E. M. Laughton*.

Uredinia only, scattered, both suprastomatal and erumpent. *F. oleoides* appears to be a new host species for this rust.

Puccinia collettiana Barclay in Sci. Mem. Med. Officers, Army of India, 5: 87 (1890).

On *Rubia cordifolia* L. India: Darjeeling, 2450m, *Henderson* 9318, II only.

Uredinia sparsely scattered; uredospores ovoid-ellipsoid, $10-15 \times 9-11 \mu\text{m}$, wall less than $0.5 \mu\text{m}$ thick, echinulate with two equatorial pores.

The rust is known from W Pakistan (Ahmad, 1956) to Sikkim.

Puccinia galopinae Cooke in Grevillea 9: 124 (1882).

On *Galopina circaeoides* Thunb. Swaziland: King's Forest, Havelock, i 1966, *Burt* 3652.

Telia only, occurring as pustular swellings on the branches of the inflorescence. The teliospores are smooth and agree completely with Doidge's (1927) description. This rust on the Rubiaceae is probably leptosporic and is clearly related to the many species described in Eurasia on *Galium* and allied genera. It could not be distinguished morphologically from many of them.

Puccinia zoysiae Dietel in Bot. Jahrb. 32: 48 (1902).

On *Paederia scandens* (Lour.) Merrill. Hongkong: New Territories, Tai Mong Tsai, 14 vii 1967, *Henderson* 9278.

Spermogonia and aecidia only; aecidia in distinct groups of 5-8 on rather swollen leaf spots; aecidiospores globose-angular, mostly $25 \times 20 \mu\text{m}$, wall finely verruculose, $1.5-2 \mu\text{m}$ thick, with one area up to $6-8 \mu\text{m}$ thick, pores 4-5, scattered, no refractive granules.

This collection is placed here on the basis of the identity of the host. The rust is known on *Paederia chinensis* in Japan and China and on many species of the alternate grass host genus *Zoysia*.

SAXIFRAGACEAE

Puccinia parkerae Dietel & Holway in *Erythea* 3: 78 (1895).

On *Ribes sachalinense* Nakai. Japan: Hokkaido, Yamabe forest, 30 vi 1967, *Henderson* 9275.

Telia only, black, with smooth-walled teliospores with thickened apex.

This species probably represents a micro-form derived from the *Puccinia caricina* complex.

Pucciniostele clarkiana (Barclay) Dietel in *Bot. Jahrb.* 27: 564 (1899).

On *Astilbe rivularis* Hamilton. India: Darjeeling, 2285m 6 viii 1967, *Henderson* 9335, Tongloo road, Darjeeling, 8 viii 1967, *Henderson* 9273.

Spermogonia, aecidia and primary telia. Spermogonia flattened, forming a subcuticular layer. Aecidia caeomoid, bright orange, in small circular groups, without peridia but with a few cells adherent to the overlying epidermis; aecidiospores elliptic, mostly $50 \times 30 \mu\text{m}$, verrucose.

The genus *Pucciniostele* has been discussed by Cummins and Thirumalachar (1953), who described both primary and secondary telia; the latter are not present in my collections, but there are present rows of quadrate verrucose cells about $20 \times 25 \mu\text{m}$ which occur occasionally in diads but usually singly and which appear to be rather intermediate between the aecidiospores and the described primary teliospores.

SCROPHULARIACEAE

Coleosporium pedicularidis Tai in *Farlowia* 3: 100 (1947).

On *Pedicularis siphonantha* Don. India: Darjeeling, Tongloo, 8 viii 1967, *Henderson* 9310.

Hypophyllous uredinia only; uredospores $23\text{--}30 \times 15\text{--}18 \mu\text{m}$, wall less than $0.5 \mu\text{m}$ thick with warts $1\text{--}1.5 \mu\text{m}$ high and $1\text{--}2 \mu\text{m}$ apart.

This seems to be the first record of a *Coleosporium* on *Pedicularis* in India. It is curious that although various races of *Coleosporium* are common over a vast area on various other semi-parasitic members of the Scrophulariaceae, *Pedicularis* is rarely infected and in fact only records on *Pedicularis* in China have been traced—on *P. cyathophylla* (Petrak, 1947) and *P. deltoides*, *P. gracilis* and *P. racemosa* (Tai, 1947).

UMBELLIFERAE

Caecoma heteromorphae Doidge in *Bothalia* 2: 190 (1926).

On *Heteromorpha arborescens* Ch. & Sch. Malawi: Mt. Mlanje, Chambe basin, 1820m, i 1967, *Burt & Hilliard* 4568.

The sori occur on gall-like leaf swellings and the caecomata are deeply immersed in the mesophyll and lack peridia. The spores are crenate, echinulate, mostly $30\text{--}35 \mu\text{m}$, rather thick-walled ($3\text{--}4 \mu\text{m}$) with distinct pores. Another rust has been described on *Heteromorpha*, *Uromyces heteromorphae* Thuem., but there is no evidence of connection with the *Caecoma*.

Puccinia angelicae (Schum.) Fuckel in Jahrb. Nass. Ver. Nat. 23-4: 52 (1869).

On *Selinum candollei* (Wall.) DC. India: Darjeeling, 2450m, 7 viii 1967, Henderson.

The collection contains only sparse uredospores with very few, smooth teliospores. The rust is recorded on this host by Butler & Bisby (1960) on the synonymous *Selinum tenuifolium*.

Puccinia hydrocotyles Cooke in Grevillea 9: 14 (1880).

On *Hydrocotyle bonariensis* Lam. Mauritius: Vacoas, 31 x 1967, Henderson 9324, II only.

Hydrocotyle bonariensis is a long-established weed in Mauritius; the rust may have been introduced with the host or may have migrated from the native species of *Hydrocotyle*.

Puccinia nanbuana Hennings in Hedwigia 40: 26 (1901).

On *Angelica polymorpha* Maxim. Japan: Kyushu, Nichinan, Inotani, 7 vii 1967, Henderson 9304.

Uredinia only, uredospores echinulate, apex thickened, pores 2 (-3) superior.

Puccinia phellopteri P. & H. Sydow, Monographia Uredinearum 1: 407 (1903).

On *Glehnia littoralis* F. Schmidt. Japan: Hokkaido, Ishikari beach, Sapporo, 29 vi 1967, Henderson 9276.

Puccinia phellopteri is a distinctive umbelliferous rust with very large uredospores in relation to teliospores; the uredospores have four equatorial pores and thick walls slightly thicker at the apex. It is known from most regions of Japan, from China and was described from Korea.

Puccinia pimpinellae (Str.) Rohl. in Deutsch. Fl. Ed. 2, 3 (3): 131 (1813).

On *Scaligeria aitchisonii* Wolff var. *multiradiata* Schulz. W Pakistan. Swat: Kalam, 2700m, 6 vii 1965, Lamond 1829, O, I only.

Three rust fungi have been recorded forming aecidia on *Scaligeria*: *P. pimpinellae*, *P. dictyoderma* and *P. bulbocastani*. It does not seem to be possible to distinguish these species absolutely in the aecidial state but the Pakistan collection agrees very well with typical *P. pimpinellae*.

Puccinia tokyensis P. & H. Sydow, Monographia Uredinearum 1: 377 (1902).

On *Cryptotaenia japonica* Hassk. Japan: Kyushu, Udo, nr. Nichinan, 7 vii 1967, Henderson 9313.

Uredinia only, small and scattered; uredospores subglobose, 25-29 \times 24-28 μ m, wall echinulate except in the region of the three equatorial pores.

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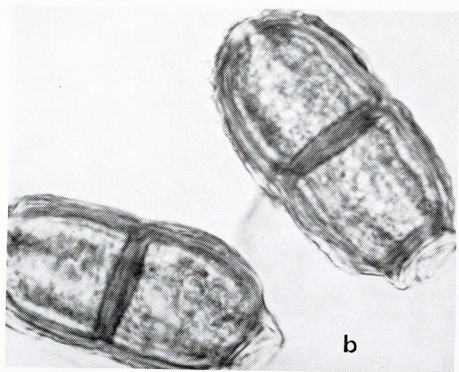


PLATE 11. a, *Puccinia scutellariae*, teliospores $\times 780$; b, *Puccinia quadricostata*, teliospores $\times 2100$.